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ABSTRACT

In 2001-2002, 23 schools in the Wake County Public School System (WCPSS), North Carolina, were provided with 40 teacher positions through the Class Size Reduction Program (CSR). Achievement results for students in reduced class sizes were compared with those of similar students in other CSR schools who did not choose the same grade for the project (keeping school and student demographics similar). At grades 1 and 2, WCPSS K-2 Literacy and Mathematics Assessments were compared pre (spring 2001) and post (spring 2002). These analyses yielded mixed results: (1) an increase in the percentage of students meeting the reading-book-level standards was greater for student in the reduced-size classes at grade 2 but not at grade 1; and (2) an increase in the percentage of students meeting the mathematics standards was greater for students in the reduced-size classes at grade 1 but not at grade 2. As in the previous year at grade 3, the North Carolina End-of-Grade fall pretest and spring posttest data indicate that, controlling for differences in pretest scores and free and reduced price lunch status of students, there were no significant differences in reading and mathematics achievement between students in reduced-size classes and those in regular-sized classes. AS in previous years, WCPSS generally did not reach a class size of 18, the goal of the enabling legislation, and it was again recommended that schools receiving 2 CSR teacher positions should place 2 teachers at the same grade level to reduce class sizes at a single grade. Three attachments contain tables of class achievement data. (Contains 15 tables.) (Author/SLD)

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A Report to the
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CLASS-SIZE REDUCTION PROGRAM EVALUATION, 2001-02

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WAKE COUNTY PUBLIC SCHOOL SYSTEM

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CLASS-SIZE REDUCTION PROGRAM EVALUATION, 2001-2002

Abstract

In 2001-02, 23 schools were provided with 40 teacher positions through the Class Size Reduction (CSR) Program. Achievement results for students in reduced class sizes were compared to those of similar students in other CSR schools who did not choose the same grade for the project (keeping school and student demographics similar). At grades 1 and 2, WCPSS K-2 Literacy and Mathematics Assessments were compared pre (spring 2001) and post (spring 2002). These analyses yielded mixed results: (a) an increase in the percentage of students meeting the reading-book-level standards was greater for students in the reduced-size classes at grade 2 but not at grade 1, and (b) an increase in the percentage of students meeting the mathematics standards was greater for students in the reduced-size classes at grade 1 but not at grade 2. As in the previous year at grade 3, the NC End-of-Grade fall pre-test and spring post-test data indicate that, controlling for differences in pre-test scores and free and reduced-price lunch status of students, there were no significant differences in reading and mathematics achievement between students in reduced-size classes and those in regular-sized classes. As in previous years, WCPSS generally did not reach a class size of 18, the goal of the enabling legislation, and it was again recommended that schools receiving two CSR teacher positions should place two teachers at the same grade level to reduce class sizes at a single grade.

Summary

Overview

In the United States, there is substantial evidence that during the early grade levels small classes can significantly improve academic achievement. This report examines the impact of the third year of the federal **Class-Size Reduction (CSR)** program in the Wake County Public School System (WCPSS) on student achievement.

In 2001-02, 23 schools were provided with 40 teacher positions through the CSR Program. Schools chosen had higher average percentages of students receiving free or reduced-price lunches (F/RL) than other WCPSS schools (29-53% compared to 23% overall in WCPSS). All elementary schools in Project Achieve plus some other schools with large numbers of F/RL students received two teacher positions, with the rest receiving one. Low-achieving students represented 10-28% of the students in the schools. All but one school chose to fund a full-time position in a separate classroom, with the new classroom about equal in size to the other classrooms within the target grade (the model that research has suggested is most likely to improve achievement). More schools placed CSR teachers at grade 1 (15) than at grades K, 2, or 3 (8-9 each).

As was the case in previous years, *WCPSS generally did not reach a class size of 18, the goal of the enabling legislation.* Although central office guidance recommended that schools receiving two teachers place them both at the same grade to try to attain class sizes of 18, only two schools did so (and only one of these reached class sizes of 18). While practical reasons likely account for the teacher placements, the fact that most student-to-teacher ratios were not 18:1 or lower likely had an impact on the assessment

results for the project. Class sizes of 18 or less were possible in only five of the 23 project schools, and some of those experienced increases in students during the school year. For schools creating an extra class at a grade level, the average class size achieved was 20.2, with an average reduction of 5.2 students.

Outcome measures were the grade-level standards of the WCPSS K-2 Literacy and Mathematics Assessments at grades 1-2 and the NC End-of-Grade (EOG) reading and mathematics tests at grade 3. Achievement results for students in reduced class sizes were compared to those of similar students in other CSR schools who did not choose the same grade for the project (keeping school and student demographics similar). For example, achievement of 1st-grade students in schools that implemented CSR in grade 1 were compared with achievement of 1st-grade students in participating schools that implemented CSR at grades 2 or 3 instead. Overall results follow.

CSR Impact on Student Achievement at Grades 1 and 2

To analyze achievement at grades 1 and 2, the percentage of students meeting grade-level standards on the WCPSS K-2 Literacy and Mathematics Assessments were compared pre (spring 2001) and post (spring 2002). These analyses yielded mixed results: (a) an increase in the percentage of students meeting the reading-book-level standards was greater for students in the reduced-size classes at grade 2 but not at grade 1, and (b) an increase in the percentage of students meeting the mathematics standards was greater for students in the reduced-size classes at grade 1 but not at grade 2.

Reading Book Level (from K-2 Literacy Assessment)

- *At grade 1, the increase in the percentage of all students meeting the reading-book-level standard was greater for students in regular-size classes than for students in reduced-size classes.*
- At grade 2, about 81% of all students in both reduced-size and regular-size classes met the grade-level standard, a decrease from 82-85% of students on the pre-test. However, decreases for all grade 2 students were less in reduced-size classes than in regular-size classes (a trend opposite from that in grade 1).
- The patterns were the same for low-income students (based on free or reduced-price lunch status) and non-low-income students.

K-2 Mathematics Assessment

- At grade 1, *the increase in the percentage of students meeting the Mathematics Assessment standard was greater for students in reduced-size classes.*
- At grade 2, the percentage of students meeting the grade-level math standard decreased from the pre-test in both regular-size and reduced-size classes. Moreover, *decreases for all students were less in regular-size classes than in CSR classes (a trend opposite from that in grade 1).*
- These patterns were the same for low-income students and non-low-income students.

CSR Impact on Student Achievement at Grade 3

As in the previous year at grade 3, the North Carolina EOG fall pre-test and spring post-test data indicate that, controlling for differences in pre-test scores and F/RL status of students, *there were no significant differences in reading and mathematics achievement between students in reduced-size classes and those in regular-size classes.*

- Controlling for pre-test differences and an indicator of income level (F/RL status), there were no significant differences in the reading or mathematics achievement gains of students in regular-size classes and those in reduced-size classes.
- This pattern remained the same when actual class sizes were controlled for in the analyses of reading and mathematics achievement. In other words, there were no significant differences between the reading achievement of students in classrooms of 18 or fewer students and the achievement of students in larger classes (whether the actual class size was in a "CSR school" or a "comparison school"). Only one CSR school had 3rd-grade class sizes of 18 or less, while other CSR schools had class sizes of 19-23 students at grade 3. Comparison schools had 23-25 students.

In Summary

Overall results are presented in the table below. Results suggest CSR had some positive impact in reading at grade 2 and math at grade 1 but no impact at grade 3. These results are consistent with class sizes being reduced but not yet at the levels recommended by research.

CSR versus Comparison Group Achievement Results, 2001-02

Grade in Spring 2002	Reading		Math	
	WCPSS K-2 Assessments	EOG	WCPSS K-2 Assessments	EOG
ALL STUDENTS				
1	CSR -		**CSR +**	
2	**CSR +**		CSR -	
3		CSR (ns)		CSR (ns)
LOW INCOME (F/RL) STUDENTS				
1	CSR -		**CSR +**	
2	**CSR +**		CSR -	
3		CSR (ns)		CSR (ns)
NON-LOW INCOME (F/RL) STUDENTS				
1	CSR -		**CSR +**	
2	**CSR +**		CSR -	
3		CSR (ns)		CSR (ns)

Note 1: At grades 1 and 2, CSR + (positive) indicates that students in reduced-size classes had greater increases (or smaller decreases) in percentage at or above the grade-level standard than students in regular-size classes. CSR - (negative) indicates the opposite: that students in reduced-size classes had lower increases.
Note 2: At grade 3, CSR (ns) indicates no significant difference between regular and reduced-size classes.

Recommendations

The following improvements are currently under way in the 2002-03 school year:

- Curriculum and Instruction (C&I) staff are training grades K-2 teachers on the use of the Kindergarten Initial Assessment and K-2 Literacy and Mathematics Assessments in order to ensure consistency in ratings among teachers. ALP II teachers are being trained as a resource for the entire school as well.
- Evaluation and Research (E&R) staff did not analyze CSR data for kindergarten this year since less is available on a pre-post basis. However, since 12 schools are utilizing CSR at kindergarten, we will analyze changes in print concept scores pre-post for the 2002-03 school year.

The following are recommendations for the next (2003-04) school year:

- Continuing to encourage schools to place the CSR teacher to form a new class about equal in size to all other classes of the targeted grade, thus decreasing the size of all classes at that grade level in the school.
- Encouraging implementation of CSR for grades K-2. The results of this evaluation, as in previous years, suggest that the impact of reduced-size classes at grade 3 was not beneficial.
- Encouraging schools to consider ways to improve benefits for low-income students, in both reading and mathematics. Low-income students had lower average pre-test scores than non-low-income students in these early grades, verifying greater instructional needs. National research suggests that low-income students show greater achievement gains when in smaller classes of 15 students or less. Only one grade in one CSR school was able to provide class sizes of 15 students in 2001-02.
- Allocating two teachers to the schools most in need and placing them at the same grade level, if necessary, to achieve class sizes below 18 students. Few schools have chosen to do so. Reasons that some administrators have reported for placing a second CSR teacher at a different grade level are overcrowding and special needs at another grade.

CLASS-SIZE REDUCTION PROGRAM EVALUATION, 2001-02

Background

The U.S. Congress first authorized the **Class-Size Reduction (CSR)** Program in 1999 under section 310 of Public Law 106-113. The purpose of the CSR program was to put 100,000 new and fully qualified teachers into public schools, within seven years, in order to reduce class size to a national average of no more than 18 students in grades one through three. The CSR program is based on a body of experimental research, including Tennessee's Project STAR, demonstrating that substantial reductions in class size have a significant effect on improving student achievement. (See E&R report # 01.30 for a review of the CSR literature.)

For fiscal year 2000, the U.S. Congress allocated $1.3 billion for the CSR program, enough for an increase above the initial 30,000 teaching positions nationwide. North Carolina received approximately $24.7 million for the initial school year and increases of $2 million for the second and third years. School district allocations were based on two factors: the number of children in poverty (80 percent) and total enrollment (20%). The allocation for WCPSS was approximately $1.6 million for the 2001-02 school year.

Evaluation Questions

Four general evaluation questions are addressed in this report:

1) What services were provided in 2001-02, the third year of federally funded efforts to reduce class sizes in grades K-3?
2) Was the program implemented as planned and, if not, why?
3) What were the effects of the program?
4) How could the program be improved?

Implementation

Implementation Plan

District staff determined that 40 teachers (an increase from 28 in 2000-01) in 23 schools could be supported through the CSR funds. The 23 schools invited to participate were those with the most need in terms of two indicators:

- Percent of students receiving free or reduced-price lunches.
- Number and percent of students whose academic achievement was below grade level.

Invited schools were the same as those for the previous school year. This was done based on the belief that stability in staffing was important to making an impact. Additionally, two CSR positions were allotted to each of the Project Achieve elementary schools to place at the same grade. The 23 schools had 29-53% of their students receiving free or reduced-price lunches. They also had 49-115 low-achieving students each, representing 22-41% of the students in the school.

District staff offered participating schools a choice of three implementation models that reflected the national guidance document. Models 1 and 2 involved adding an additional classroom, and Model 3 involved having an additional teacher rotate to team with the regular teachers at a grade level. (Descriptions are presented in Table 1.) District staff recommended the selection of Model 1 unless adequate space was not available for an additional classroom.

Actual Implementation

As in the previous year, all 23 of the invited schools chose to participate, and all returned the required form in fall 2001 showing that they were implementing one of the available models in an appropriate grade. (See Attachment 1 for a listing of participating schools and the grade levels and models selected by each school.)

Services Provided

As shown in Table 1, students were served in different target grades and by two implementation models. Of the 23 participating schools, 22 chose Model 1, and one school chose Model 3.

Table 1
Frequency for Each CSR Implementation Model and Grade Level, 2001-02

Implementation Model	Kinder-garten	Grade 1	Grade 2	Grade 3	Total
1. Teacher of new class **about equal in size to** all other classes of the target grade	8	15	8	7	*38*
2. Teacher of new class **substantially smaller than** other classes of the target grade	0	0	0	0	*0*
3. Rotating teacher shared equally **among all** of the classes of the target grade. (No additional classrooms available)	0	0	1	1	*2*
Total	*8*	*15*	*9*	*8*	*40*

Forty teachers funded by the CSR program enabled reduced-size classes for 3,954 students at four grade levels. For every teacher position funded, about 99 students were affected. The numbers of students served within each implementation model and grade level are shown in Table 2.

Table 2
Number of Students Served for Each CSR Implementation Model and Grade Level, 2001-02

Implementation Model	Kinder-garten	Grade 1	Grade 2	Grade 3	Total
1. Teacher of new class **about equal in size to** all other classes of the target grade	838	1,448	786	675	*3,747*
2. Teacher of new class **substantially smaller than** other classes of the target grade	0	0	0	0	*0*
3. Rotating teacher shared equally **among all** of the classes of the target grade.	0	0	103	104	*207*
Total	*838*	*1,448*	*889*	*779*	*3,954*

As depicted in Table 3, the amount of class-size reduction achieved varied by implementation model, with the most reduction achieved under Model 1 (about five students per class) and the least under Model 3 (2.8 students per class). See Attachment 1 for a complete listing of participating schools, number of positions added by CSR funding, and class sizes before and after the addition of CSR positions.

Table 3
Class-Size Reduction Achieved for Implementation Models 1 and 3, 2001-02

Model	Students Served	Average Class Size Before	Average Class Size After	Average Reduction in Class Size
Model 1	3,747	25.3	**20.1**	5.2
Model 3	207	26.0	**23.2**	2.8

As in 2000-01, adding CSR teachers to these schools did not result in classes as small as the size recommended by the enabling legislation (18 or fewer). In order to reduce the average class size to 18 in grades K-3 in WCPSS, often two teaching positions would have to be added per grade level using Model 1. Of the 15 schools allocated two or more teacher positions, only two chose to place two teacher positions at the same grade level in 2001-02 (and only one of those attained a class size of 18 or less, as recommended by the CSR literature). Eight schools received only one CSR position. Another factor that sometimes limits class-size reduction is the enrollment of new students after the school year begins.

Effects of the Program

CSR Teacher Feedback on Program Effectiveness

Between spring 2001 and spring 2002, the CSR Teacher Survey was revised to avoid redundancy and decrease teacher time in completing the survey. The 57 multiple-choice items on the previous survey were reduced to 18, making some comparisons across years possible. Also, two open-response questions were added so that teachers could describe any growth in class size during the school year and specify any professional development completed to help them take advantage of their smaller classes.

One hundred and thirty-one of the 147 CSR teachers surveyed in the 23 schools (at the grade level where CSR was implemented) completed the revised survey in spring 2002. The complete questionnaire and results are shown in Attachment 2. As in the earlier survey, the items on the spring 2002 CSR Teacher Survey fell into six clusters, cited in class-size reduction research, addressing issues related to instruction, individualization, student engagement, achievement, parental involvement, and the global benefits of reduced-size classes.

On the whole, teachers were very positive about the benefits of CSR, with more than three fourths of all respondents reporting "some" impact of CSR for every item. About 73-79% of respondents reported "much" or "very much" CSR impact for the survey items in Table 4.

Table 4
CSR Teacher Survey Items with Highest Ratings, 2001-02

Item #	Cluster	Compared to regular class sizes, to what extent do you believe that...	% Responding "Much" or "Very Much"	% Responding "Little" or "None"
4	Instruction	You use more flexible small-group instruction in your class?	**79%**	8%
10	Individualization	You know each of your students' abilities better?	**79%**	7%
16	Instruction	You use more hands-on activities (such as art, manipulatives in mathematics, or drama in reading)?	**76%**	9%
2	Instruction	You use more variety in your instructional practice?	**73%**	8%
6	Individualization	You provide more individualized instruction to students?	**73%**	11%
12	Student Engagement	Your students have a closer relationship with you?	**73%**	8%

Note: One hundred thirty-one of 147 teachers responded to the questionnaire for a response rate of 89%. These included the allotted CSR teachers plus the other teachers on their grade-level teams whose class sizes were reduced because of the addition of a CSR teacher. In addition to categories shown, "No Opinion" or "Some" were response options.

Teachers tended to be most positive about items related to whether CSR facilitates desired changes in their instruction and enables individualization within the classroom. Respondents reported that their smaller classes allowed them to become closer to their students and better able to assess students' needs and abilities. Additionally, respondents indicated that their smaller

classes permitted more variation in classroom activities, especially more small-group and hands-on activities. Overall, there was relatively little variation in teacher responses, with most items in the survey eliciting moderate to high ratings, yet 17-28% of respondents reported "little" or "none" CSR impact for the four items listed in Table 5.

Table 5
CSR Teacher Survey Items with Lowest Ratings, 2001-02

Item #	Cluster	To what extent do you believe that...	% Responding "Agree" or "Strongly Agree"	% Responding "Disagree" or "Strongly Disagree"
1	Global	Your class is small enough to see the benefits of class-size reduction?	69%	28%
		Compared to regular class sizes, to what extent do you believe that...	**% Responding "Much" or "Very Much"**	**% Responding "Little" or "None"**
5	Student Engagement	You spend less time on discipline?	61%	22%
7	Instruction	You spend less time on non-instructional activities?	50%	22%
11	Global	Your interest in teaching is higher?	68%	17%

Note: One hundred thirty-one teachers responded to the questionnaire for a response rate of 89%. These included the allotted CSR teachers plus the other teachers on their grade-level teams whose class sizes were reduced because of the addition of a CSR teacher. In addition to categories shown, "No Opinion" or "Some" were response options.

Teachers with more negative responses could be those who saw less class size reduction (among other reasons). The fact that more than three fourths of the teachers reported that their class was not small enough supports this view. It may also explain why more than 20% of respondents reported that they did not spend less time on discipline or non-instructional activities (22%) as a result of CSR, and that CSR did not raise their level of interest in teaching (17%). These more negative results may be related to the fact that *28% of* the *teachers surveyed "disagreed" or "strongly disagreed" that their class was small enough to see the benefits of class-size reduction.*

Most teachers *did* report benefits of reduced class size but, as in previous years, some reported that their classes might not be small enough for those benefits to materialize. As one teacher wrote on the survey form, "I have 22 students, and that's an improvement over 27." Others commented similarly. Several teachers wrote that even though they began the year with the recommended number of students, they received additional students throughout the year. Thus, as in previous years, teachers who reported fewer benefits of CSR may not reject the theoretical basis of class-size reduction but may, instead, be teaching in contexts relatively smaller than before but with less reduction in class size than recommended by most experimental research (15) or the enabling legislation (18 or less).

Overall, however, the teachers generally concurred with the benefits of reduced-size classes, with 69% indicating that, as a result of CSR, their low-achieving students are learning more in their smaller classes.

Comparisons of Teacher Feedback, 2000-01 and 2001-02

A comparison of the responses for items on both spring 2001 and spring 2002 surveys shows that participants gave higher ratings for eight of the 17 comparable items in 2002 than in the previous year (see Table 6). Among the thematic clusters, five of six instructional practice items and all student achievement items received higher ratings in 2001-02 than in the previous year. Notably, the increase in percentage of teachers believing that their students would attain higher achievement was substantial, with 71% of teachers in 2001-02 reporting this, compared to only 35% the previous year. However, the increase must be treated with caution because the wording of the item on the two surveys was somewhat different, and not all the teachers participating in the CSR program in 2001-02 were the same individuals with reduced class sizes in the previous year.

Table 6
Comparisons of CSR Teacher Survey Results, Spring 2001 and Spring 2002

Cluster	Compared to regular class sizes, to what extent do you believe that...	% Agreeing "Much" or "Very Much"		% Agreeing "Little" or "None"	
		00-01	01-02	00-01	01-02
Instruction	You use more flexible small-group instruction in your class?	82%	79%	3%	8%
Instruction	You use more hands-on activities (such as art, manipulatives in mathematics, or drama in reading)?	71%	**76%**	3%	9%
Instruction	You use more variety in your instructional practice?	61%	**73%**	5%	8%
Instruction	You spend less time on non-instructional activities:	44%	**50%**	25%	22%
Instruction	Room arrangement is more flexible in your class?	62%	**67%**	11%	14%
Instruction	You have more time for reinforcing activities?	65%	**69%**	9%	11%
Individualization	You provide more individualized instruction to students?	83%	73%	4%	11%
Individualization	Your students have a closer relationship with you?	76%	73%	6%	8%
Individualization	You know each of your student's abilities better?	85%	79%	4%	7%
Individualization	You give more feedback that is tailored to each individual student?	78%	69%	3%	9%
Student Engagement	You spend less time on discipline?	63%	61%	17%	22%
Student Engagement	Your students are more enthusiastic about learning?	66%	65%	8%	8%
Achievement	Your students learn critical thinking skills better?	55%	**65%**	15%	12%
Achievement	Very low-achieving students are learning more in your class?	61%	**69%**	6%	11%
Achievement	Your students will have higher academic achievement? (01-02)/Your students will score higher on K-5 classroom profiles or EOGs? (00-01)	35%	**71%**	34%	10%
Parental Involvement	You communicate more to your students' parents?	67%	60%	9%	8%
Global	Your interest in teaching is higher?	71%	68%	7%	17%

Note: Shading indicates an increase in agreement from the previous year.

Respondents' rates of agreement with student engagement items remained about the same, but agreement with individualization items decreased from the previous year. One item showed a drop of 10%: the percentage of teachers reporting that they individualized instruction more with their smaller class decreased from 83% to 73%.

Overall, 27% of teachers in both 2000-01 and 2001-02 reported that their classes were not small enough to provide the benefits of class size reduction, probably because in both years, the average size of CSR classes did not meet the size recommended by the enabling legislation (18 or less). CSR teachers in 2001-02 reported higher expectations for students and changes in some instructional practices but less differentiation (individualizing instruction, tailoring feedback, knowing each student's abilities, and establishing personal relationships).

See Attachment 2 for a complete list of survey items and responses.

Impact on Student Achievement

Method and Measures

As noted earlier, the 23 WCPSS elementary schools receiving CSR funding chose to target different grade levels. Since these schools are more alike in terms of demographics and previous student performance than other Wake County schools, it would be inappropriate to construct comparison groups from the district as a whole. Therefore, for purposes of this study, E&R staff members chose to compare the achievement of students in schools where CSR was implemented at one grade level with the achievement of students in other schools where CSR was implemented at another grade level. For example, among the project schools, achievement of third-grade students in schools that implemented CSR, Model 1, in Grade 3 are compared with achievement of 3rd-grade students in participating schools implementing CSR at grades 1 or 2 instead. In this way, grade-level comparisons of achievement in reading and mathematics are made between students in reduced-size classes and students in regular-size classes within the 23 project schools.

In North Carolina, academic progress and achievement in grades K-2 is assessed using local observational profiles - for math and literacy - that are utilized by teachers throughout the year. At the end of the school year, teachers then record the summary ratings from each student's completed profile folders on data-capture scan sheets collected centrally. The WCPSS K-2 Mathematics and Literacy Assessments, based on specific goals and objectives from the *NC Standard Course of Study*, have been used district-wide since 1997. Teachers indicate a student's progress on the objectives, with each rating based on teacher observations of a student's demonstrated level of performance and reflecting multiple demonstrations of an objective by the student. However, the K-2 assessment ratings are more subjective in nature than standardized test results and, thus, have lower statistical reliability than the NC End-of-Grade (EOG) test scores.

To examine the impact of enrollment in CSR-funded classes on students in grades K-2, the reading and math achievement of CSR students in 2001-02 was compared against these students' achievement in the previous year to determine the percentage of students with reading book levels and math levels at or above the grade-level standard in each year. Standards were set by

C&I staff based on progress they believed would be necessary for students to show grade-level performance in grades K-2. Thus, while assessment results played a part in the setting of standards, professional judgment also played a part. District results suggest standards at some grades are somewhat more difficult to meet than at other grades.

Statewide standardized tests are not administered until the 3rd grade, where students complete EOG mathematics and reading pre-tests at the beginning of the school year and post-tests near the end of the school year. (Note: The EOG third-grade pre-tests are shorter in length than the post-tests and, therefore, the reliability of pre-test results is lower. However, a lengthier pre-test is considered developmentally inappropriate for students entering grade 3.)

Reading and math NC EOG scores were used to determine the effects of class size reduction on students in Grade 3 in 2001-02. E&R staff used least squares regression analyses to reduce any bias due to pre-existing differences among the third-grade students in the two groups. The first analysis was used to account for (control) differences in student background in two areas - prior achievement (pre-test score) and an indicator of family-income level (whether students are receiving F/R lunches) – when comparing the achievement of students in the reduced-size classes and the regular-size classes.

Next, because it was possible that "real" class sizes might be no different in the two groups whose achievement was being compared, a second regression analysis was used to gauge the effects of CSR on achievement. This second analysis was based on students' actual class sizes rather than the two categories of reduced-size classes (created by the allotment of a CSR teacher position) and regular-size class (no CSR teacher position allotted).

An evaluation was not conducted for kindergarten students because common data from pre- and post-tests were considered insufficient. Also, since no equivalent comparison group was available for the single implementation of Model 3, no comparisons were made for that model.

Reading Book Levels from Literacy Profiles, Grades 1-2

The WCPSS K-2 Literacy Assessment provides ratings that show development in academic achievement from grades K-2. One measure in particular, the reading book level (ranging from *None* to *Level 31-32*), is based on a standard protocol, and the other literacy measures are highly correlated with it. Different books, emphasizing and enhancing specific reading objectives, are available for each of the book levels. K-2 Reading Assessment findings include the following:

Grade 1

- About three-fourths of all students in both reduced- and regular-size classes met the first grade reading-book-level standard, even with a higher standard (reading book level 15-16) being used in spring 2002. (The district average was 78%.)
- *Increases in percentage of students meeting the grade-level standard were greater in regular-size classes than in CSR classes. The pattern was the same for low-income (based on F/R lunch status) and non-low-income students,* although there was less difference (0.3 to 0.5 of a percentage point) in increases between low-income students in CSR classes and

regular-size classes. Non-low-income students, however, made substantial increases (20 percentage points) in regular-size classes, compared to their average increase (3.5 percentage points) in CSR classes.

Grade 2

- About 81% of all students in both reduced- and regular-size classes met the grade-level standard at the end of the year, a decrease from 82-85% on the pre-test. (Remember that standards may not be of equal difficulty.) However, *decreases for all students, F/RL students, and non-F/RL students were less in reduced-size classes (CSR) than in regular-size classes, a trend opposite from that in grade 1.*

Low-income students (those receiving free or reduced-price lunches) had lower pre- and post-test scores than non-low-income students at both grades 1 and 2.

Overall results for Model 1 at each grade level are summarized in Table 7.

One limitation of this methodology is a lack of statistical testing to check whether differences could occur by chance. Another is that students in the two groups could be closer or further from the standard, making it easier or more difficult to meet the standard. We are considering other analyses to compare book levels pre- to post for 2002-03 and, if this is done, will analyze both 2001-02 and 2002-03 results.

Table 7
Reading Book Level Results, CSR Model 1, by Grade Level for All Students, F/R Lunch Students, and Non-F/R Lunch Students, 2000-01 and 2001-02

Grade	Reduced Class Size			Regular Class Size		
	Pre-Test: % at or above Standard	Post-Test: % at or above Standard	Increase in Percentage Points at or above Standard	Pre-Test: % at or above Standard	Post-Test: % at or above Standard	Increase in Percentage Points at or above Standard
All Students						
K to 1	67.8	72.9	5.1	60.8	75.1	**14.3**
1 to 2	81.8	80.5	**-1.3**	84.7	80.7	-4.0
Free- and Reduced-Price Lunch Students						
K to 1	53.9	62.0	8.1	50.0	58.6	**8.6**
1 to 2	71.5	70.7	**-0.8**	76.9	75.8	-1.1
Non Free- and Reduced-Price Lunch Students						
K to 1	78.0	81.5	3.5	69.7	89.7	**20.0**
1 to 2	90.7	88.1	**-2.6**	89.3	83.5	-5.8

Note 1: For 2000-01, the standard was a reading book level of 13-14 for first grade and 23-24 for second grade -- with a re-telling score of 3 or 4 (on a four-point scale). For 2001-02, the standard for first grade increased to book level 15-16. Reading book level is an indicator of fluency and comprehension.
Note 2: Sample size ranged from 518 to 1,455 students.

WCPSS Mathematics Assessments, Grades 1-2

Using the WCPSS K-2 Mathematics Assessments, teachers throughout the year rate each student's performance on a I-IV scale on the four math strands in the *NC Standard Course of Study*. At year's end, students with ratings of III or IV on three of the four math strands are deemed to have achieved the standard for a particular grade level. Mathematics findings include the following:

Grade 1

- About 78% of all students in both reduced- and regular-size classes met the grade-level standard for mathematics.
- *Increases were greater in CSR classes than in regular-sized classes for all students, low-income students, and non-low-income students. Low-income students made substantial increases (27.8 percentage points) in CSR classes at grade 1.*

Grade 2

- About 72% of all students in reduced-size classes and 71% in regular-size classes met the grade-level standard on the post-test, a decrease from 80-81% on the pre-test.
- *However, decreases for all students, F/RL students, and non-F/RL students were less in regular-size classes than in reduced-size classes, a trend opposite from that in grade 1.*

Low-income students had lower pre- and post-test scores than non-low-income students.

Overall results for Model 1 at each grade level are summarized in Table 8.

Table 8
K-2 Mathematics Assessments Results, CSR Model 1, by Grade Level for All Students, F/R Lunch Students, and Non-F/R Lunch Students, Spring 2001 and Spring 2002

Grade	Reduced Class Size			Regular Class Size		
	Pre-Test: % at or above Standard	Post-Test: % at or above Standard	Increase in Percentage Points at or above Standard	Pre-Test: % at or above Standard	Post-Test: % at or above Standard	Increase in Percentage Points at or above Standard
All Students						
K to 1	57.2	78.1	**20.9**	63.4	78.5	15.1
1 to 2	79.8	72.4	-7.4	81.3	77.0	**-4.3**
Free- and Reduced-Price Lunch Students						
K to 1	40.7	68.5	**27.8**	51.5	70.6	19.1
1 to 2	69.5	59.8	-9.7	72.6	67.5	**-5.1**
Non Free- and Reduced-Price Lunch Students						
K to 1	73.1	85.2	**12.1**	79.4	86.9	7.5
1 to 2	87.8	82.9	-4.9	87.2	82.9	**-4.3**

Note 1: Students with ratings of III or IV (within a 1-4 scale) on at least three of the four math strands were deemed to have achieved the standard.
Note 2: Sample size ranged from 649 to 1,503 students.

NC End-of-Grade Reading and Mathematics Assessments, Grade 3

Standardized NC EOG assessment results are reported for 3rd-grade students. The NC accountability program includes pre- and post- assessments of 3rd-grade reading and mathematics, with the pre-tests administered at the beginning of the school year and the post-tests administered in late spring of the same school year. (As noted earlier, the pre-test has lower reliability than the post-test.) Raw scores of the EOG tests are converted to scale scores so that test results can be compared on a common scale across years. Analyses conducted by the NC Department of Public Instruction indicate that no ceiling effects are found on either the pre- or post-tests.

EOG pre- and post-test results were available for 1,206 (582 CSR and 624 non-CSR) third-grade students in the participating schools who had both reading and mathematics scores. The average scale scores - and the standard deviation of each – for students in reduced-size classes and in regular-size classes are shown in Table 9. Descriptively, students who were in reduced-size classes had slightly lower, but statistically similar, average scale scores on mathematics and reading pre-tests than those in regular-size classes. Average growth in scale points was similar for both groups of students.

Table 9
Means and Standard Deviations of 3rd-Grade EOG
Mathematics and Reading Results, Spring 2001 and Spring 2002

Variables	Reduced Class Size			Regular Class Size		
	Mean/ Average Scale Score	Standard Deviation	Average Growth in Scale-Score Points from Pre to Post	Mean/ Average Scale Score	Standard Deviation	Average Growth in Scale-Score Points from Pre to Post
Grade 3 Math Pre-Test	237.7	7.5	14.7	238.2	7.9	14.3
Grade 3 Math Post-Test	252.4	7.2		252.5	7.6	
Grade 3 Reading Pre-Test	139.5	7.9	8.7	139.6	8.4	8.5
Grade 3 Reading Post-Test	148.2	8.4		148.1	9.0	

Note 1: N=1,206 students.
Note 2: The standard deviation is a measure of the amount of variation in scores within which about two-thirds of the students fall. For example, a standard deviation of 8.4 indicates that about two-thirds of the students had scores that were 8.4 scale points above or below the average scale score.

To clarify the effects of class size reduction, E&R staff used least squares regression analyses to control for any bias due to pre-existing differences among the students in the two groups. The purpose of this procedure was to account for differences in student background in the areas of prior achievement (EOG pre-test score) and an indicator of family income (F/RL status) when examining the main effects of class size reduction.

Next, because it was possible that "real" class sizes might not be different in the two groups (CSR classes and regular-size classes), a second series of regression analyses were conducted, this time using students' actual class sizes rather than students' membership in classes designated as CSR or non-CSR. Only two schools had 3rd-grade class sizes below 19 while the other five schools with CSR teachers at 3rd grade had classes of 19-22 students. Comparison group classes had a range of 23-25 students, not much larger than the reduced-size classes.

EOG Reading, Grade 3

Findings are the same as those of the previous years:

- Over and above the impact of EOG pre-test reading scores and an indicator of family income (F/R lunch status), class size reduction did not contribute positively to reading achievement between EOG third-grade reading pre-tests and post-tests.
- Similarly, controlling for the same variables, actual class size did not contribute positively to reading achievement at grade 3.

EOG Mathematics, Grade 3

Again, findings are the same as those of the previous year:

- Over and above the impact of EOG pre-test mathematics scores and family income (F/RL status), class size reduction did not contribute positively to mathematics achievement between EOG third-grade mathematics pre-tests and post-tests.
- Controlling for the same variables, actual class size did not contribute positively to mathematics achievement at grade 3.

In other words, after controlling for pre-test scores and an indicator of family income, the number of students in a class was not a significant predictor of either post-test reading scores or post-test mathematics scores. Numerical results of the regression analyses for grade 3 are shown in Attachment 3.

Summary and Recommendations

The summary and recommendations are at the beginning of this evaluation report.

Attachment 1

Class Size Reduction Achieved by Grade Level and School, 2001-02

School	Grade	Class Size Before	Class Size After	Reduced	# of Students Affected	# of Positions Added	Model #
Cary	K	23.4	19.5	3.9	117	1	1
Hodge Rd.	K	27.2	20.4	6.8	163	2	1
Jeffreys Grove	K	25.3	19.0	6.3	76	1	1
Smith	K	25.6	19.3	6.3	77	1	1
Vandora Springs	K	27.5	22.0	5.5	110	1	1
Wilburn	K	27.0	23.6	3.4	189	1	1
Willow Springs	K	21.2	17.7	3.5	106	1	1
Totals/Averages	**K**	**25.4**	**20.2**	5.2	**838**	**8**	
Carver	1	22.8	16.3	6.5	114	2	1
Cary	1	22.2	18.5	3.7	111	1	1
Conn	1	29.3	22.0	7.3	88	1	1
Creech Rd.	1	24.3	17.8	6.5	71	1	1
Dillard Dr.	1	26.5	21.2	5.3	106	1	1
Fox Rd	1	26.8	23.0	3.8	138	1	1
Jeffreys Grove	1	31.7	23.8	8.0	95	1	1
Knightdale	1	24.0	20.0	4.0	120	1	1
Lockhart	1	24.4	20.3	4.1	122	1	1
Millbrook	1	24.0	19.2	4.8	96	1	1
Rand Rd.	1	26.0	19.5	6.5	78	1	1
Smith	1	25.3	19.0	6.3	76	1	1
Vandora Springs	1	17.8	14.2	3.6	71	1	1
Wake Forest	1	27.0	23.9	3.1	162	1	1
Totals/Averages	**1**	**25.0**	**19.8**	5.1	**1,448**	**15**	
Aversboro	2	26.7	20.0	6.7	80	1	1
Cary	2	24.6	20.5	4.1	123	1	1
Creech Rd.	2	27.7	19.8	7.9	79	1	1
Millbrook	2	24.8	19.8	5.0	99	1	1
Rand Rd.	2	31.5	21.0	10.5	63	1	1
Smith	2	27.0	20.3	6.7	81	1	1
Vance	2	28.3	21.3	7.0	85	1	1
Wilburn	2	25.2	22.0	3.2	176	1	1
Zebulon (Model 3)	2	26.0	23.2	2.8	104	1	3
Totals/Averages	**2**	**26.2**	**20.7**	5.5	**786**	**9**	
Brentwood	3	29.7	22.3	7.4	89	1	1
Dillard Dr.	3	25.0	20.0	5.0	100	1	1
Knightdale	3	27.3	19.8	7.5	99	1	1
Lockhart	3	28.0	22.4	5.6	112	1	1
Powell	3	24.0	18.3	5.7	73	1	1
Rolesville	3	23.0	19.2	3.8	115	1	1
Vance	3	21.8	17.4	4.4	87	1	1
Zebulon (Model 3)	3	26.0	23.3	2.7	103	1	3
Totals/Averages	**3**	**25.0**	**19.9**	5.1	**778**	**40**	

Attachment 2

CSR Teacher Questionnaire with Percentage by Category for Each Item, Spring 2002

QUESTIONS	ANSWERS				
To what extent do you believe that:	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1. Your class is small enough to see the benefits of class size reduction?	9.9%	17.6%	1.5%	34.4%	34.4%
If not, what was your class size? Why was it not small enough?					
Compared to regular-size classes, to what extent do you believe that:	None	Little	Some	Much	Very Much
2. You use more variety in your instructional practices?	3.8%	3.8%	18.3%	38.9%	34.4%
3. Your students will have higher academic achievement?	3.1%	6.9%	19.1%	35.9%	35.1%
4. You use more flexible small-group instruction in your class?	3.8%	3.8%	13.7%	28.2%	50.4%
5. You spend less time on discipline?	9.2%	13.0%	16.0%	26.7%	34.4%
6. You provide more individualized instruction to students?	3.8%	6.9%	16.0%	32.1%	41.2%
7. You spend less time on non-instructional activities?	7.6%	14.5%	26.0%	23.7%	26.0%
8. Room arrangement is more flexible in your class?	7.6%	6.1%	19.1%	28.2%	38.9%
9. You communicate more with your students' parents?	2.3%	6.1%	32.1%	32.8%	26.7%
10. You know each of your student's abilities better?	3.1%	3.8%	14.5%	35.1%	43.5%
11. Your interest in teaching is higher?	6.1%	10.7%	15.3%	32.1%	35.9%
12. Your students have a closer relationship with you?	2.3%	6.1%	18.3%	30.5%	42.7%
13. Very low-achieving students are learning more in your class?	3.8%	6.9%	19.8%	33.6%	35.9%
14. You give more feedback that is tailored to each individual student?	2.3%	6.9%	21.4%	29.0%	40.5%
15. Your students are more enthusiastic about learning?	3.1%	5.3%	26.0%	38.2%	26.7%
16. You use more hands-on activities (such as art, manipulatives in mathematics, or drama in reading)?	3.8%	5.3%	14.5%	42.7%	32.8%
17. You have more time for reinforcing activities?	6.1%	4.6%	20.6%	31.3%	37.4%
18. Your students learn critical thinking skills better?	3.8%	8.4%	20.6%	38.2%	26.7%
19. *Please record any growth in your class size across the school year.*					
20. *Did you receive any training this year that was helpful to you in taking advantage of your smaller class size? Have you identified any training needs?*					

Attachment 3

Results of Regression Analyses, Grade 3 Math and Reading Book Levels

Results of Regression of Third-Grade Reading Post Scores on Reading Pre and FRL.

Summary of Fit

RSquare	0.495166
RSquare Adj	0.494327
Root Mean Square Error	6.189015
Mean of Response	148.1609
Observations (or Sum Wgts)	1206

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	2	45197.198	22598.6	589.9816
Error	1203	46079.595	38.3	Prob > F
C. Total	1205	91276.793		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	50.485532	3.177119	15.89	<.0001
Reading pre	0.6981866	0.0228	30.62	<.0001
FRL[0]	1.1788104	0.189412	6.22	<.0001

Results of Regression of Reading Post Scores on Reading Pre, FRL, and CSR (categorical)

Summary of Fit

RSquare	0.495278
RSquare Adj	0.494019
Root Mean Square Error	6.190901
Mean of Response	148.1609
Observations (or Sum Wgts)	1206

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	3	45207.432	15069.1	393.1704
Error	1202	46069.361	38.3	Prob > F
C. Total	1205	91276.793		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	50.471641	3.178201	15.88	<.0001
Reading pre	0.6983105	0.022808	30.62	<.0001
FRL[0]	1.1778769	0.189479	6.22	<.0001
CSR[0]	-0.09218	0.178393	-0.52	0.6054

Results of Regression of Reading Post Scores on Reading Pre, FRL, and Class Size (continuous)

Summary of Fit

RSquare	0.495501
RSquare Adj	0.494242
Root Mean Square Error	6.189537
Mean of Response	148.1609
Observations (or Sum Wgts)	1206

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	3	45227.737	15075.9	393.5205
Error	1202	46049.056	38.3	Prob > F
C. Total	1205	91276.793		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	51.990504	3.596821	14.45	<.0001
Reading pre	0.6981659	0.022802	30.62	<.0001
FRL[0]	1.1707639	0.189643	6.17	<.0001
Class size	-0.068215	0.076403	-0.89	0.3721

Results of Regression of Third-Grade Math Post Scores on Math Pre and FRL.

Summary of Fit

RSquare	0.560595
RSquare Adj	0.559865
Root Mean Square Error	4.919144
Mean of Response	252.4809
Observations (or Sum Wgts)	1206

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	2	37138.898	18569.4	767.3968
Error	1203	29110.163	24.2	Prob > F
C. Total	1205	66249.061		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	90.919196	4.595766	19.78	<.0001
Math pre	0.6782154	0.019341	35.07	<.0001
FRL[0]	0.7906577	0.152552	5.18	<.0001

Results of Regression of Math Post Scores on Math Pre, FRL, and CSR (Categorical)

Summary of Fit

RSquare	0.560608
RSquare Adj	0.559512
Root Mean Square Error	4.921116
Mean of Response	252.4809
Observations (or Sum Wgts)	1206

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	3	37139.770	12379.9	511.1999
Error	1202	29109.292	24.2	Prob > F
C. Total	1205	66249.061		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	90.892406	4.599777	19.76	<.0001
Math pre	0.6783323	0.019359	35.04	<.0001
FRL[0]	0.7901721	0.152635	5.18	<.0001
CSR[0]	-0.026913	0.141868	-0.19	0.8496

Results of Regression of Math Post Scores on Math Pre, FRL, and Class Size (Continuous)

Summary of Fit

RSquare	0.560659
RSquare Adj	0.559562
Root Mean Square Error	4.920833
Mean of Response	252.4809
Observations (or Sum Wgts)	1206

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	3	37143.118	12381.0	511.3048
Error	1202	29105.943	24.2	Prob > F
C. Total	1205	66249.061		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	91.439562	4.76332	19.20	<.0001
Math pre	0.678376	0.019351	35.06	<.0001
FRL[0]	0.7872378	0.152824	5.15	<.0001
Class size	-0.025364	0.060754	-0.42	0.6764

CLASS-SIZE REDUCTION PROGRAM EVALUATION, 2000-2001

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